Reg. No.															

Question Paper Code	13296

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Fifth Semester

Computer Science and Business Systems

20CBPC502 - DESIGN AND ANALYSIS OF ALGORITHMS

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)

Answer ALL Questions

		Marks	*K – Level*	*CO*
1.	A trade-off between time and space complexity involves: (a) Increasing memory to reduce execution time (b) Decreasing code length to improve readability (c) Using more CPU cycles to save memory (d) Using dynamic programming to save execution time	*1*	*K1*	*CO1*
2.	The performance of an algorithm can be measured in terms of: (a) Execution time and memory usage (b) Code length and modularity (c) Software version and hardware specifications (d) User interface and usability	*1*	*K1*	*CO1*
3.	Which of the following is NOT a characteristic of a good algorithm? (a) Unambiguity (b) Finiteness (c) Definiteness (d) Inconsistency	*1*	*K1*	*CO1*
4.	What is a recurrence relation? (a) An equation that describes a function in terms of its previous values (b) A method for solving non-recursive algorithms (c) A technique used exclusively for iterative algorithms (d) A tool for analyzing algorithm correctness	*1*	*K1*	*CO2*
5.	What is the time complexity of the recurrence relation $T(n) = 2T(n/2) + O(n)$? (a) $O(n)$ (b) $O(n \log n)$ (c) $O(n^2)$ (d) $O(\log n)$	*1*	*K1*	*CO2*
6.	In a recursion tree, what does the height of the tree represent? (a) The number of function calls (b) The maximum depth of recursion (c) The total time complexity (d) The space complexity	*1*	*K1*	*CO2*
7.	A greedy algorithm for the activity selection problem chooses activities based on: (a) Earliest start time (b) Shortest duration (c) Latest finish time (d) Earliest finish time	*1*	*K1*	*CO3*
8.	Which of the following is NOT a heuristic method? (a) Hill Climbing (b) Simulated Annealing (c) Branch and Bound (d) Genetic Algorithm	*1*	*K1*	*CO3*
9.	Bin packing problems are classified as: (a) Polynomial-time problems (b) NP-complete problems (c) P-complete problems (d) Linear-time problems	*1*	*K1*	*CO3*
10.	What characterizes a directed graph (DiGraph)? (a) It has no edges. (b) Edges have no specific direction. (c) It contains cycles. (d) Edges have a specific direction, going from one vertex to another.	*1*	*K1*	*CO4*
11.	What is the primary advantage of breadth-first search (BFS) over depth-first search (DFS)? (a) Requires less memory (b) Guarantees finding the shortest path (c) Suitable for exploring deep into a branch (d) More memory-efficient	*1*	*K1*	*CO4*

12. Dijkstra's Algorithm is one example of a _____ shortest path algorithm. *1 K1 CO4*
    (a) Single-source Shortest path algorithm (b) All-pairs Shortest path algorithm
    (c) Minimum spanning tree (d) Topological sorting
13. Which of the following problems is an example of a tractable problem? *1 K1 CO5*
    (a) Sorting an array using merge sort (b) The Traveling Salesman Problem (TSP)
    (c) Boolean Satisfiability (SAT) Problem (d) Hamiltonian Cycle Problem
14. Which class of problems did Cook's Theorem introduce? *1 K1 CO5*
    (a) P (b) NP-hard (c) NP-complete (d) PSPACE
15. Which of the following is NOT true about NP-complete problems? *1 K1 CO5*
    (a) Every NP-complete problem is in NP
    (b) If any NP-complete problem can be solved in polynomial time, all NP problems can be
    (c) Every problem in P is NP-complete
    (d) NP-complete problems are the hardest problems in NP
16. Which of the following time complexities represents a intractable problem? *1 K1 CO5*
    (a) O(n!) (b) O(n^2) (c) O(n^3) (d) O(n)
17. Which of the following is a real-world application of quantum computing? *1 K1 CO6*
    (a) Solving NP-complete problems in polynomial time
    (b) Simulating molecular structures for drug discovery
    (c) Solving simple arithmetic problems
    (d) Enhancing cloud storage
18. Which of the following types of randomized algorithms always gives a correct result but has a random running time? *1 K1 CO6*
    (a) Monte Carlo algorithm (b) Las Vegas algorithm
    (c) Greedy algorithm (d) Approximation algorithm
19. What is the primary difference between an exact algorithm and an approximation algorithm? *1 K1 CO6*
    (a) Exact algorithms are always faster than approximation algorithms
    (b) Approximation algorithms guarantee an exact solution
    (c) Exact algorithms always find the optimal solution, while approximation algorithms find near-optimal solutions in less time
    (d) Approximation algorithms solve problems that exact algorithms cannot solve
20. What is superposition in quantum computing? *1 K1 CO6*
    (a) The ability of a qubit to be in multiple states (0 and 1) simultaneously
    (b) The process of measuring a qubit's state
    (c) A type of quantum entanglement
    (d) The collapsing of a qubit's state to 0 or 1

PART - B (10 × 2 = 20 Marks)

Answer ALL Questions

21. How to measure the algorithm running time? *2 K1 CO1*
22. Summarize the key steps in problem-solving? *2 K2 CO1*
23. What is a recurrence tree? *2 K1 CO2*
24. When would you use the substitution method? *2 K1 CO2*
25. Define the term exhaustive search. *2 K1 CO3*
26. Outline the Principle of Optimality. *2 K2 CO3*
27. What does Floyd's algorithm do? *2 K1 CO4*
28. Define topological sorting. *2 K1 CO4*
29. List some examples of P and NP problem. *2 K1 CO5*
30. What is Relative approximation? *2 K1 CO6*

PART - C (6 × 10 = 60 Marks)

Answer ALL Questions

31. a) Explain the performance measurements of algorithm Time and Space trade off. *10 K2 CO1*

OR

b) Explain briefly on Big oh Notation, Omega Notation and Theta Notations. Depict the same graphically. *10 K2 CO1*

32. a) Explain in detail about Mathematical analysis of recursive algorithms. *10 K2 CO2*

OR

b) Explain in detail about Recursion Tree Method with example. *10 K2 CO2*

33. a) Solve the following instance of the knapsack problem using the branch and bound algorithm. Knapsack capacity W=10. *10 K3 CO3*

Item	Weight	Value
1	4	$40
2	7	$42
3	5	$25
4	3	$12

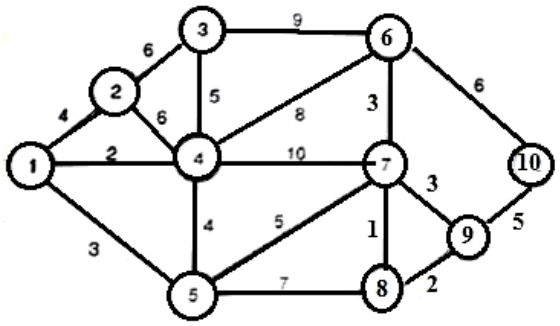
OR

b) Solve the travelling salesperson instance defined by the following cost matrix *10 K3 CO3*

∞	20	30	10	11
15	∞	16	4	2
3	5	∞	2	4
19	6	18	∞	3
16	4	7	16	∞

Draw the state space tree and show the reduced matrices corresponding to each of the node.

34. a) Outline the minimum spanning tree using Prim's algorithm. *10 K2 CO4*



OR

b) Demonstrate single source shortest path used in Dijkstra's Algorithm with an Example. *10 K2 CO4*

35. a) Explain Cook's theorem in detail. *10 K2 CO5*

OR

b) Compare and contrast between Tractable and non-tractable problems with suitable examples. *10 K2 CO5*

36. a) Illustrate Vertex Cover Randomized algorithm in detail. *10 K2 CO6*

OR

b) Explain in detail about polynomial approximation Algorithm with example. *10 K2 CO6*